Environmental Resources Management, Inc.

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114672

15 May 1989

Mr. Eugene Pine
PADER, Bureau of Waste Management
7th Floor, Fulton Building
Harrisburg, PA 17120

FILE: 272-15

Dear Gene:

On behalf of Ciba Geigy Corporation and Monsey Products, please find enclosed final revisions to the Kimberton Remedial Investigation and Feasibility Study Reports which incorporate both the DER and EPA comments presented in your 4 May 1989 correspondence. As agreed upon during our conference call of 9 May 1989, revisions have been made to specified pages with supplemental pages inserted where appropriate.

Each DER and EPA comment in your letter of 4 May 1989 has been addressed below for clarification. These responses are as agreed upon during the conference call with you on 9 May 1989.

Revisions to Remedial Investigation Report

Comment: Revision: Section 6 Soils Investigation (DER):

There still is no mention of the OVA probe change in Lagoon 3C.

Response: Revision: Section 6 Soils Investigation (DER):

The drill logs in Appendix 18 indicate that there was an OVA probe change made during sampling of Lagoon 3C. In agreement with our telephone conversation, no revision to the RI Report is necessary.

Comment: Revision 5, Page 1-3 (EPA):

This revision gives the incorrect impression that no VOC's were detected in Lagoon 1. Lagoon 1, in fact, contains 70 ppb TCE and 9 ppb chlorobenzene.

Response: Revision 5, Page 1-3 (EPA):

Section 1 is an introductory section that summarizes the results of previous investigations. No organic compounds were detected in samples collected from Lagoon 1 during the previous soils investigation summarized in the "Hydrogeologic Assessment on

Ground Water Conditions in Kimberton, Pennsylvania; Groundwater Technology, Inc.; Chadds Ford, Pennsylvania; January 31, 1983." In agreement with our telephone conversation, no revision to the RI Report is necessary.

Comment: Revision 44, Appendix 22 (EPA):

The statement that EPA guidelines require Class C carcinogens to be addressed as noncarcinogens is incorrect. The guidelines expressly leave this decision to the judgement of the risk assessor, who is advised to consider specific characteristics of the compound and the site.

Past EPA Region III risk assessments have typically treated 1,1-DCE as a carcinogen. There does not appear to be any reason to change this practice for Kimberton.

Revision: Revision 44, Appendix 22 (EPA):

The text and tables have been changed where appropriate to indicate 1,1-dichloroethene as Class C (possible human) carcinogen and its evaluation as a potential carcinogen for this site. In order to reflect the true magnitude of human risk, the final risk estimate has been coupled with the EPA weight-of-evidence classification. This bracketed designation of quantitative weight-of-evidence is included on all numerical risk estimates to indicate the uncertainties surrounding the derivation of the carcinogenic potency factor for this compound as it relates to the other indicator compounds for the site.

The changes in the Appendix 22 text and tables for inclusion of 1,1-dichloroethene as a potential carcinogen are as follows:

Page 5-1. Paragraph 5 now reads: "1,1-Dichloroethene is a Class C, possible human carcinogen, based on limited evidence of carcinogenicity in animals and no evidence in humans." The sentence "Therefore, this compound will be evaluated as a noncarcinogen in this EA" has been deleted.

Page 5-2. Section 5.2.4. The "d" in dichloroethene was capitalized.

Page 6-4. First paragraph, third line now reads "The lifetime-weighted noncarcinogenic hazard index for dermal contact with and inhalation of surface water containing trans-1,2-trichloroethene is presented in Table 6-3."

Page 6-4. Second complete paragraph. Last sentence has been deleted.

Page 6-4. Section 6.4. Second paragraph has been changed to include 1,1-dichloroethene as a potential carcinogen, bracketed values for the weight-of-evidence have been included, and the risk per compound has been presented.

Page 6-5. First paragraph. Second sentence, second bullet now reads "2 x 10^{-8}."

Page 6-6. Section 6.6. Risk Perspective. The third paragraph, first sentence now reads "An additional hypothetical lifetime risk from use of untreated ground water containing trichloroethene, 1,1-dichloroethene, and vinyl chloride is calculated to be 1 x 10^{-3} [B2], 2 x 10^{-3} [C], and 1 x 10^{-2} [A], respectively, ..."

Page 6-7. First paragraph has been modified to include 1,1-dichloroethene.

Page 7-2. Hypothetical. The second bullet has been deleted and third bullet now reads "Carcinogenic risks from trichloroethene, 1,1-dichloroethene, and vinyl chloride exposure in untreated ground water are 1 x 10^{-3} [B2], 2 x 10^{-3} [C], and 1 x 10^{-2} [A], respectively which are one to two orders of magnitude above the US EPA's recommended guideline of 1 x 10^{-4} to 1 x 10^{-7} for CERCLA sites."

Table 5-1. The CPF for inhalation and oral exposures to 1,1-dichloroethene were added.

Table 5-2. The oral and inhalation potency factors for 1,1-dichloroethene were added.

Table 6-3. 1,1-Dichloroethene was deleted.

Table 6-4. 1,1-Dichloroethene was added.

Table 1 in the Executive Summary. Changes were made to the noncarcinogenic hazard indices to reflect the change from a noncarcinogen to a potential carcinogen for 1,1-dichloroethene.

Revisions to Feasibility Study Report

Comment: Figure 1-3. GAC system locations

This figure still has the incorrect A/B designations. Refer to Revised Figure 1-8 in the RI.

<u>Revision: Figure 1-3, GAC system locations</u>

Figure 1-3 of the FS shall be replaced with Figure 1-8 of the RI, and shall be relabelled Figure 1-3 for the FS.

<u>Comment: Figure 1-4, Flow Lines</u>

This figure contains five flow lines, while the corresponding figure in the RI (Fig. 4.4) only contains four. Were any interstitial velocities calculated for this additional flow line as in the RI (page 4-27) for flow lines I-IV?

<u>Revision: Figure 1-4, Flow Lines</u>

Figure 1-4 shall be replaced with a new Figure 1-4, that does not include Flowline V. This shall make the figure consistent with Figure 4.4 in the RI.

<u>Comment: Figure 1-6, TVO Concentrations;</u>

This Figure should have been similar to the revised figure in Appendix 5 (RI, 2/21/89 rev.) showing slightly different contours.

<u>Revision: Figure 1-6, TVO Concentrations;</u>

Figure 1-6 of the FS shall be replaced with the figure found in Appendix 5 of the RI, and shall be labelled Figure 1-6 for the FS.

<u>Comment: Table 1-10;</u>

This table should be revised/updated as follows:

1) The longer-term adult health advisory level for vinyl chloride is 50 ppb.
2) The lifetime adult health advisory level for 1,1-dichloroethene is 7 ppb.
3) The proposed MCL for trans-1,2-dichloroethene is 100 ppb, as is the lifetime adult health advisory level.
4) The final MCL for 1,1,1-trichloroethane is 200 ppb (not 20), as is the lifetime adult health advisory level.
5) The longer-term adult health advisory level for 1,3-dichloropropene is 100 ppb.
6) The proposed MCL for toluene is 2000 ppb, as is the lifetime adult health advisory level.

7) The proposed MCL for monochlorobenzene is 100 ppb, as is the lifetime adult health advisory level.

8) The proposed MCL for 1,2-dichloropropane is 5 ppb.

9) We cannot verify the listed drinking water levels for tetrachloroethane; is tetrachloroethene meant instead?

Revision: Table 1-10:

The longterm or lifetime adult health advisory levels given above were checked on the Public Health Risk Evaluation Database (PHRED). Table 1-10 has been modified to reflect the following values taken from the PHRED system: vinyl chloride - 46 ppb as long-term health advisory level (HAL); 1,1-dichloroethene - 7 ppb as lifetime HAL; trans-1,2-dichloroethene - 100 ppb as the proposed MCL and 70 ppb as lifetime HAL; 1,1,1-trichloroethane - 200 ppb MCL and 200 ppb lifetime HAL; 1,3-dichloropropene - 105 ppb as long-term HAL; toluene - 2,000 as proposed MCL and 2420 ppb lifetime HAL; monochlorobenzene - 100 ppb as proposed MCL and 300 ppb lifetime HAL; 1,2-dichloropropane - 5 ppb as proposed MCL; and tetrachloroethene 10 ppb as lifetime HAL.

In accordance with your directive, these changes will not be made in the corresponding table in the EA Report (Table 6-2).

Comment: Page 2-4, Section 2.3.1:

Isocon contours are depicted of Figure 1-6, not Figure 1-7 as stated.

Revision: Page 2-4, Section 2.3.1:

Page 2-4 will be replaced with a revised Page 2-4, which references Figure 1-6, not Figure 1-7.

Comment: Figure 4-2:

The legend should explain what the isocon lines are.

Revision: Figure 4-2:

Figures 4-2 and 4-3 shall be replaced with new Figures 4-2 and 4-3 that include a legend indicating that the isoconcentration lines are approximations of total VOC concentrations.

Comment: Figure 4-4:

This figure should include representative concentrations in the legend.

Revision: Figure 4-4:

Figure 4-4 shall be replaced with a new Figure 4-4. This new figure shall include a footnote in the legend referring to Table 4-1 for an explanation of the zones.

Comment: Table 4-1:

The entries for certain wells in this table are somewhat inaccurate: Well 16 (2345 ppb VOC's) put in 1000-2000 ppb category; President's Well (1101 ppb) put in trace-1000 ppb category; and Well 12 (1620 ppb) put in trace-1000 ppb category. Only Well 12, however, is significantly out of range. The isocon line on Figure 4-4 should be moved to accommodate this one correction.

Revision: Table 4-1:

The zones delineated in Figure 4-4 and referenced in Table 4-1 have been based on the most recent total VOC concentrations detected in the monitoring wells (June of 1986 & March, June, August 1988). Historical analytical data (May 1985 to present) for the monitoring wells indicate a reduction in total VOC concentrations with time for several of the wells (Tables 1-1 through 1-4). The concentrations displayed in Table 4-1 are representative of the average concentrations over time (May 1985 to present), and are therefore considered conservative. Because these are averaged, they may indicate a higher total VOC concentration than the zone in which they have been placed. The following revisions shall be made to clarify this item.

Table 4-1 shall be replaced with a new Table 4-1. This new table shall include a footnote that the zones were established based upon the approximate total VOC isoconcentration contours developed from the most recent monitoring well data (June 1986 & March, June, August 1988).

Figure 4-4 will not be revised except in response to the previous comment.

Comment: Page 5-2, Section 5.2.1.3:

Were any drawdown predictions made for areas immediately across the street (Cold Stream Road) from the site? Such predictions are possible with the model, and would be of value in determining drawdown in the areas of several domestic wells as a result of the proposed extraction system.

Revision: Page 5-2, Section 5.2.1.3:

The ground water table in the vicinity was contoured for Alternative 4 (phased ground water recovery) and is shown in Appendix B Figures B-14 and B-16. These figures can be compared to Figure B-5, which is the present conditions simulation of the ground water table. It can be seen that the ground water table has been lowered by 5 to 25 feet in the vicinity across from Cold Stream Road. However, because a public water system shall be installed, there is expected to be no continued extraction of ground water from the nearby domestic wells. The following revision will be made to the FS:

Page 5-2 will be replaced with a new Page 5-2, that includes a statement under the subsection"Environmental Impacts." This statement reads: "However, because a public water system shall be installed, there is expected to be no continued extraction of ground water from nearby domestic wells."

Attachments 1 and 2 to this letter include revised pages and instructions for incorporating these pages into the RI and FS Reports, respectively. We hope that these revisions clarify the comments made. Please do not hesitate to contact Stewart Johnson or me if you have any questions.

Sincerely,

Deborah M. Watkins

Deborah M. Watkins, P.E.
Project Engineer

Enclosures

cc: S. Johnson, Ciba-Geigy
J. Doyle, Monsey Products
B. Stonelake, Blank, Rome, Comisky & McCauley
B. Whitman, Dechert, Price & Rhoads
F. Aceto, GTI
P. Tan, USEPA, Region III
B. Boyd, PADER, Norristown

ATTACHMENT 1

FINAL REVISIONS TO REMEDIAL INVESTIGATION REPORT

1. Replace Title Page with the attached Title Page (Revised).
2. Replace Table 1 in the Executive Summary of Appendix 22 with the attached Table 1 (Revised).
3. Replace Section 5 of Appendix 22 with the attached Section 5 (Revised).
4. Replace Pages 6-4 through 6-7 of Appendix 22 with the attached Pages 6-4 through 6-7 (Revised).
5. Replace Tables 6-3 and 6-4 of Appendix 22 with the attached Tables 6-3 and 6-4 (Revised).
6. Replace Page 7-2 of Appendix 22 with the attached Page 7-2 (Revised).
7. Replace References in Appendix 22 with the attached References.

REMEDIAL INVESTIGATION REPORT
KIMBERTON, PENNSYLVANIA
NPL SITE

14 October 1988
Revised 15 February 1989
Revised 15 May 1989

Prepared By:

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The ERM Group

Table 1

Summary of the Risks at the Kimberton Site

CONDITIONS	DESCRIPTION	LIFETIME WEIGHTED CARCINOGENIC RISK *
CARCINOGENIC RISK		
Actual (carbon systems)	- ground water only	approximately 0
	- all pathways	2 E-08
Hypothetical	- dermal contact and inhalation at streams - ground water use and seeps/springs (child 6-12) - dermal contact with stream sediments (child 6-12)	1 E-02

CONDITIONS	DESCRIPTION	LIFETIME WEIGHTED NONCARCINOGENIC HAZARD INDEX **
NONCARCINOGENIC HAZARD		
Actual (carbon systems)	- ground water only	approximately 0
	- all pathways	3.36E-06
Hypothetical	- ground water use	1.67E+00
	- dermal contact with sediments (child 6-12)	0 ***
	- inhalation of VOCs in stream (child 6-12)	1.21E-06
	- inhalation of VOCs in seeps/springs (child 6-12)	2.35E-06

Bold values indicate that the calculated risk is outside the US EPA's recommended ranges.
Carcinogenic recommended guidelines - 1.00E-04 to 1.00E-07 (US EPA)
Hazard index - less than one (US EPA)

* Indicators are trichloroethene, 1,1-dichloroethene, and vinyl chloride (benzo(a)pyrene, benzo(a)anthracene, and benzo(b)fluoranthene in sediments)
**Indicator is trans-1,2-dichloroethene.
***Noncarcinogenic PAHs were not evaluated since AISs and RfDs were not available.

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Revised 5/10/89

SECTION 5

TOXICITY EVALUATION

5.1 Introduction

The toxicity evaluation of the indicator compounds selected for the Kimberton Site is conducted to identify relevant toxicity indices and acceptable daily intakes against which exposure point intakes can be compared in the risk characterization of the site. The methodology for this toxicity evaluation is discussed in Section 2. A detailed discussion of U.S. EPA's weight-of-evidence classification system is presented in Appendix B.

5.2 Toxicology Classification

Agents that are judged to be in the EPA weight-of-evidence classification Groups A and B would be regarded as suitable for quantitative risk assessments. Agents that are judged to be in Group C will generally be regarded as suitable for quantitative risk assessment, but judgments in this regard may be made on a case-by-case basis. Agents that are judged to be in Groups D and E would not have quantitative risk assessments (Federal Register, 1986, p33996). EPA Region III have typically treated Class C carcinogens (i.e., 1,1-dichloroethene) in the quantitative risk assessments with Class A and B carcinogens.

The final risk estimate will be generally rounded to one significant figure and will be coupled with the EPA classification of the qualitative weight of evidence. For example, a lifetime individual risk of 2×10^{-4} resulting from exposure to a "probable human carcinogen" (Group B2) should be designated as: 2×10^{-4} [B2]. This bracketed designation of the qualitative weight of evidence should be included with all numerical risk estimates (Federal Register, 1986, p33999).

The level of evidence classified for carcinogenicity for the Kimberton Site indicator compounds is discussed below. There is a significant controversy in the international scientific community surrounding the classification of trichloroethene. EPA has classified trichloroethene as a probable human (Class B2) carcinogen. In this Risk Assessment, ERM has regarded trichloroethene according to EPA's classification and has included it in the carcinogenic risk assessment.

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trans-1,2-Dichloroethene is classified as a noncarcinogen by U.S. EPA and IARC. Vinyl chloride is classified as a human carcinogen by U.S. EPA. Based on its potency factors, vinyl chloride can be considered a moderately potent carcinogen compared to the handful of other known human carcinogens classified by EPA.

1,1-Dichloroethene is a Class C, possible human carcinogen based on limited evidence of carcinogenicity in animals and no evidence in humans.

Benzo(a)pyrene, benzo(a)anthrancene, and benzo(b)fluoranthene are classified as B2 carcinogens, that is, potential human carcinogens. Table 5-1 presents the relevant quantitative indices of toxicity for the indicator compounds that will be used in risk characterization.

The toxicity data presented below are summarized from EPA Health Effects Assessment documents and other sources. A detailed toxicology profile for each indicator is presented in Appendix E; the major health effects resulting from exposure to indicator compounds will be discussed below. However, the concentrations at which toxic effects occur are generally orders of magnitude higher than environmental concentrations of those compounds.

5.2.1 Trichloroethene

In humans, TCE was once used medically for its anesthetic and analgesic properties. Exposures to high concentrations of TCE are known to elicit cardiac arrhythmias. Chronic exposure has been reported to induce neurotoxic (toxic to nerves or the nervous system) symptoms such as involuntary muscular movements, sleep disturbances, and psychotic episodes.

5.2.2 trans-1,2-Dichloroethene

trans-1,2-Dichloroethene's (trans-DCE) toxicity has not been well studied in animals or humans. Exposure to high vapor concentrations of trans-DCE causes nausea, vomiting, weakness, tremor, and cramps in humans. Exposure to vapors can also produce anesthetic and narcotic effects. Chronic exposure to low levels of trans-DCE in animals resulted in no observable changes in pathology.

5.2.3 Vinyl Chloride

Vinyl chloride causes depression of the central nervous system and may cause death due to narcosis. Long-term exposure can lead to syndromes which includes liver and kidney damage, thickening of the skin, changes in the circulation and bone structure of the digits, and hematologic effects. Vinyl chloride has been proven

TABLE 5 - 1

RELEVANT QUANTITATIVE INDICES OF TOXICITY FOR THE INDICATOR COMPOUNDS

COMPOUND		ORAL AIS mg/kg/day	ORAL RfD mg/kg/day	CPF-Inhalation 1/(mg/kg/day)	CPF-Oral 1/(mg/kg/day)
trans-1,2-Dichloroethene	(a)	2.00E-01	2.00E-02	NA	NA
Trichloroethene	(a)	NA	NA	1.30E-02	1.10E-02
Vinyl chloride	(a)	NA	NA	2.95E-01	2.30E+00
1,1-Dichloroethene	(a)	9.00E-03	9.00E-03	1.20E+00	6.00E-01
Benzo(a)pyrene	(c)	NA	NA	1.15E+01	NA
Benzo(a)anthracene	(c)	NA	NA	1.67E+00	NA
Benzo(b)fluoranthene	(c)	NA	NA	1.61E+00	NA

NA - not applicable

(a) - CPF value obtained from IRIS database

(b) - CPF value obtained from Superfund Public Health Evaluation Manual

(c) - Thorslund et al , 1987

to cause cancer of the liver, brain, lungs, digestive system, and the blood-forming tissues in exposed workers. Vinyl chloride also causes toxic effects to fetusus and may cause developmental defects.

5.2.4 1,1-Dichloroethene

1,1-Dichloroethene causes kidney tumors in males, and leukemia in males and females in one study of mice exposed by inhalation; gave equivocal results in other inhalation studies; gave negative results in rats and mice following oral exposure; and gave negative results in hamsters following inhalation exposures. 1,1-DCE was mutagenic in several bacterial assays. 1,1-dichloroethene did not appear to be teratogenic but did cause embryotoxicity and fetotoxicity when administered to rats and rabbits by inhalation. Chronic exposure to oral doses of 1,1-DCE as low as 5 mg/kg/day caused a number of changes in rats. Acute exposure to high doses causes central nervous depression, but neurotoxicity has not been associated below-level chronic exposure. The oral LD_{50} value for the rat is 1,500 mg/kg, and for the mouse, 200 mg/kg.

5.2.5 Polycyclic Aromatic Hydrocarbons (PAHs)

Carcinogenic polycyclic aromatic hydrocarbons (PAHs) are persistent in the environment. The potential for PAHs to induce malignant transformation dominates the consideration of health hazards resulting from exposure, because there are often no overt signs of toxicity until the dose is high enough to produce a high tumor incident. No case reports or epidemiological studies considering the significance of human exposure to individual PAHs are available. PAHs, administered by various routes, have been found to be carcinogenic in several animal species and to have local and systemic carcinogenic effects. Administered orally, carcinogenic PAHs produce tumors of the forestomach in mice. Lung tumors are produced in hamsters after intratrachial administration and in mice after intravenous administration. In skin painting experiments with mice, carcinogenic PAHs produce skin carcinomas. Other observed effects include production of local sarcomas and an increased incident of lung ademomas in mice following a single, subcutaneous injections. Studies in other species, while indicating that PAHs have universal carcinogenic effects, are less complete.

Carcinogenic PAHs are reported to be mutagenic in a variety of systems. The limited available information suggests that PAHs re not very potent teratogens or reproductive toxins. There is very little information regarding nonmalignant changes caused by exposure to PAHs. Application of carcinogenic PAHs to mouse skin is reported to cause deterioration of sebaceous glands, hyperplasia, hyperkeratosis, and ulceration. Workers exposed to PAH-containing materials have exhibited chronic dermatitis, hyperkeratosis, and other skin disorders. Little information is available on the environmental toxicity of PAHs to wildlife and domestic animals, in particular to aquatic organisms.

5.3 Applicable or Relevant and Appropriate Requirements (ARARs)

As discussed in Section 2.2, evaluation of exposure point concentrations compared with environmental standards is an important part of the CERCLA RA process. Applicable, or relevant and appropriate requirements for each indicator chemical are presented in Table 5-2.

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TABLE 5 - 2

SUMMARY OF TOXICOLOGICAL INFORMATION, STANDARDS, AND GUIDANCE VALUES FOR INDICATOR COMPOUNDS

RELEVANT REQUIREMENTS, CRITERIA, ADVISORIES OR GUIDANCE		trans-1,2-Dichloroethene	Trichloroethene	Vinyl chloride	1,1-Dichloroethene	Benzo(a) pyrene	Benzo(a) anthracene	Benzo(b) fluoranthene
EPA MCL	(mg/L)		5.00E-03	2.00E-03	N/A	N/A	N/A	N/A
EPA MCGL	(mg/L)	7.00E-02 P	0	0	N/A	N/A	N/A	N/A
EPA WATER QUALITY CRITERIA (mg/L)								
fish and drinking water		-	2.70E-03	2.00E-03				
fish only		-	8.07E-02	5.25E-01				
protection of freshwater aquatic life (acute)		1.16E+01	4.50E+01	-				
protection of freshwater aquatic life (chronic)		-	2.19E+01	-				
WORLD HEALTH ORGANIZATION GUIDELINE			3.00E-02					
OSHA 8 hr TWA-TLV (mg/m3)		7.90E+02	5.40E+02	2.62E+00				
ACGIH 8 hr TWA-TLV (mg/m3)		7.90E+02	2.70E+02	1.31E+01				
NONCARCINOGENIC EFFECTS								
RISK CHARACTERIZATION								
ORAL								
AIS	(mg/kg/day)	2.00E-01	NA	NA	9.00E-03	NA	NA	NA
AIC	(mg/kg/day)	2.00E-02	NA	NA	9.00E-03	NA	NA	NA
RfD	(mg/kg/day)	NA	5.40E-01	2.00E-03	9.00E-03	NA	NA	NA
INHALATION								
AIS	(mg/kg/day)				N/A	NA	NA	NA
AIC	(mg/kg/day)				N/A	NA	NA	NA
RfD	(mg/kg/day)				N/A	NA	NA	NA
MEDIAN EFFECTIVE DOSE								
ORAL	(mg/kg/day)	1.89E+02	9.50E+00	2.28E+02				
INHALATION	(mg/kg/day)	1.89E+02	2.70E+00	2.28E+02				
CARCINOGENIC EFFECTS								
POTENCY FACTOR								
ORAL	1/(mg/kg/day)	NA	1.10E-02	2.30E+00	6.00E-01			
INHALATION	1/(mg/kg/day)	NA	1.30E-02	2.95E-01	1.20E+00	1.15E+01	1.67E+00	1.61E+00
10% EFFECTIVE DOSE ORAL	(mg/kg/day)	NA	6.62E+00	6.67E+00				
CLASSIFICATION, EPA		noncarcinogen	B2	A	C	B2	B2	B2
CLASSIFICATION, IARC		noncarcinogen	3	1	3	2B	2B	2B

N/A - NOT AVAILABLE
NA - not applicable
Sources: Ambient Water Quality Criteria Document, USEPA 1986
Superfund Public Health Evaluation Manual, USEPA 1986
Intergrated Risk Information System (IRIS), USEPA on-line
Bold format indicates changes in table.

that no hazard exists. The assessment of the noncarcinogenic hazard for the site is shown in Table 6-3. Chronic (long-term) hypothetical exposure scenarios are calculated to attain hazard indices.

A lifetime-weighted noncarcinogenic hazard index does not exist under the current ground water exposure scenario (i.e., treated ground water). Actual exposure to surface waters by children age 6-12 does exist for this site. The lifetime-weighted noncarcinogenic hazard index for dermal contact with and inhalation of surface water containing trans-1,2-dichloroethene is presented in Table 6-3. The chronic hazard indices are less than one which is below U.S. EPA's guideline.

The main noncarcinogenic hazard arises from the presence of trans-1,2-DCE in ground water. Ingestion of drinking water and inhalation of compounds during bathing for children ages 2-6 are the main exposure pathways and cause the noncarcinogenic subchronic hazard index to exceed one. The noncarcinogenic subchronic hazard index also exceeds one for inhalation of trans-1,2-DCE during bathing for children ages 6-12. The noncarcinogenic chronic hazard exceeds one for ingestion of water and inhalation during bathing for all age groups.

6.4 Calculation of Carcinogenic Risk

It should be noted that the carcinogenic risk posed by contaminants detected in the ground water at the site prior to the carbon treatment system in hypothetical. Current exposure to the residents from ground water is zero owing to the installation of carbon treatment systems at the residences of the potentially exposed population.

The assessments of potential carcinogenic risks from trichloroethene, vinyl chloride, and 1,1-dichloroethene exposures for hypothetical conditions are presented in Table 6-4. Only chronic daily intakes are used to calculate carcinogenic risk. The total lifetime weighted risk from exposure to vinyl chloride, trichloroethene, and 1,1-dichloroethene in untreated ground water at residential wells are 1×10^{-2}[A], 1×10^{-3}[B2], and 2×10^{-3}[C], respectively. Vinyl chloride concentrations are localized in the north-central portion of the site and the affected wells are extremely limited in number. This calculated risk is above U.S. EPA's recommended range of 1×10^{-4} to 1×10^{-7} for CERCLA sites. This calculated risk is attributed to inhalation of vinyl chloride, TCE, and 1,1-dichloroethene by children 6-12 and adults during bathing and ingestion of vinyl chloride by children 6-12.

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TABLE 6-3
Noncarcinogenic Hazard Index

ROUTE OF EXPOSURE	EXPOSURE MEDIA	EXPOSED POPULATION	CHEMICAL	SDI (mg/kg/day)	AIS (mg/kg/day)	SDI/AIS	CDI (mg/kg/day)	RfD (mg/kg/day)	Weighted Hazard Index
INHALATION	GROUND WATER (bathing)	ADULT	trans-1,2-Dichloroethene	3.25E-04	2.00E-01	1.63E-03	2.11E-05	2.00E-02	9.01E-04
		Child 6-12	trans-1,2-Dichloroethene	1.73E+00	2.00E-01	8.66E+00	1.13E-01	2.00E-02	4.96E-01
		Child 2-6	trans-1,2-Dichloroethene	1.71E+00	2.00E-01	8.55E+00	1.11E-01	2.00E-02	3.27E-01
	SURFACE WATER (Streams)	Child 6-12	trans-1,2-Dichloroethene	2.91E-04	2.00E-01	1.46E-03	2.74E-07	2.00E-02	1.21E-06
	SURFACE WATER (Seeps & Springs)	Child 6-12	trans-1,2-Dichloroethene	4.31E-04	2.00E-01	2.16E-03	5.32E-07	2.00E-02	2.35E-06
DERMAL CONTACT	GROUND WATER (bathing)	ADULT	trans-1,2-Dichloroethene	3.25E-04	2.00E-01	1.63E-03	2.11E-05	2.00E-02	9.01E-04
		Child 6-12	trans-1,2-Dichloroethene	4.53E-04	2.00E-01	2.26E-03	2.94E-05	2.00E-02	1.30E-04
		Child 2-6	trans-1,2-Dichloroethene	5.47E-04	2.00E-01	2.74E-03	3.55E-05	2.00E-02	1.05E-04
	SURFACE WATER (Streams)	Child 6-12	trans-1,2-Dichloroethene	2.42E-06	2.00E-01	1.21E-05	2.38E-07	2.00E-02	1.05E-06
	SURFACE WATER (Seeps & Springs)	Child 6-12	trans-1,2-Dichloroethene	2.85E-06	2.00E-01	1.43E-05	8.51E-07	2.00E-02	3.75E-06
	SEDIMENT (Stream A)	Child 6-12	None evaluated						
INGESTION	GROUND WATER	ADULT	trans-1,2-Dichloroethene	2.17E-01	2.00E-01	1.09E+00	1.41E-02	2.00E-02	6.02E-01
		Child 6-12	trans-1,2-Dichloroethene	5.24E-01	2.00E-01	2.62E+00	3.41E-02	2.00E-02	1.50E-01
		Child 2-6	trans-1,2-Dichloroethene	4.75E-01	2.00E-01	2.38E+00	3.08E-02	2.00E-02	9.07E-02

Lifetime-weighted hazard index (all exposures)= 1.67E+00

Additional exposure pathways evaluated (1989)

exposure to sediments= 0.00E+00
Inhalation exposure to Streams= 1.21E-06
Inhalation exposure to Seeps & springs= 2.35E-06

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TABLE 6-4
ASSESSMENT OF LIFETIME-WEIGHTED CARCINOGENIC RISK

Exposed Population	Exposure Media	Route of Exposure	Indicator Compound	Chronic Intake (mg/kg/day)	CPF 1/(mg/kg/day)	Route/Compound Specific Risk
Adults	Ground Water	Dermal Contact	Trichloroethene	2.18E-05	1.10E-02	2 E-07
		Bathing	Vinyl Chloride	3.51E-06	2.30E+00	7 E-06
			1,1-Dichloroethene	3.04E-07	6.00E-01	2 E-07
		Ingestion	Trichloroethene	1.45E-02	1.10E-02	1 E-04
			Vinyl Chloride	2.35E-03	2.30E+00	5 E-03
			1,1-Dichloroethene	2.03E-04	6.00E-01	1 E-04
		Inhalation	Trichloroethene	8.69E-02	1.30E-02	1 E-03
		Bathing	Vinyl Chloride	1.40E-02	2.95E-01	4 E-03
			1,1-Dichloroethene	1.21E-03	1.20E+00	1 E-03
Children 6-12	Ground Water	Dermal Contact	Trichloroethene	3.03E-05	1.10E-02	3 E-08
		Bathing	Vinyl Chloride	4.89E-06	2.30E+00	1 E-06
			1,1-Dichloroethene	4.23E-07	6.00E-01	2 E-08
		Ingestion	Trichloroethene	3.51E-02	1.10E-02	3 E-05
			Vinyl Chloride	5.66E-03	2.30E+00	1 E-03
			1,1-Dichloroethene	4.90E-04	6.00E-01	3 E-05
		Inhalation	Trichloroethene	1.16E-01	1.30E-02	1 E-04
		Bathing	Vinyl Chloride	1.87E-02	2.95E-01	5 E-04
			1,1-Dichloroethene	1.62E-03	1.20E+00	2 E-04
	Surface Water	Dermal Contact	Trichloroethene	2.14E-07	1.10E-02	2 E-10
		(streams)	Vinyl Chloride	0.00E+00	2.30E+00	0 E+00
			1,1-Dichloroethene	0.00E+00	6.00E-01	0 E+00
		Inhalation	Trichloroethene	8.51E-07	1.10E-02	8 E-10
		(streams)	Vinyl Chloride	0.00E+00	2.95E-01	0 E+00
			1,1-Dichloroethene	0.00E+00	6.00E-01	0 E+00
	Surface Water	Dermal Contact	Trichloroethene	2.14E-07	1.10E-02	2 E-10
		(seeps &springs)	Vinyl Chloride	0.00E+00	2.30E+00	0 E+00
			1,1-Dichloroethene	0.00E+00	6.00E-01	0 E+00
		Inhalation	Trichloroethene	1.93E-06	1.10E-02	2 E-09
		(seeps &springs)	Vinyl Chloride	0.00E+00	2.95E-01	0 E+00
			1,1-Dichloroethene	5.14E-09	1.20E+00	5 E-10
	Sediments	Dermal contact	Benzo(a)pyrene	1.22E-08	1.15E+01	1 E-08
			Benzo(a)anthracene	1.17E-08	1.67E+00	2 E-09
			Benzo(b)fluoranthene	1.22E-08	1.61E+00	2 E-09
Children 2-6	Ground Water	Dermal Contact	Trichloroethene	3.66E-05	1.10E-02	2 E-08
		Bathing	Vinyl Chloride	5.90E-06	2.30E+00	8 E-07
			1,1-Dichloroethene	5.11E-07	6.00E-01	2 E-08
		Ingestion	Trichloroethene	3.18E-02	1.10E-02	2 E-05
		Drinking Water	Vinyl Chloride	5.13E-03	2.30E+00	7 E-04
			1,1-Dichloroethene	4.44E-04	6.00E-01	2 E-05
		Inhalation	Trichloroethene	1.14E-01	1.30E-02	9 E-05
		Bathing	Vinyl Chloride	1.85E-02	2.95E-01	3 E-04
			1,1-Dichloroethene	1.60E-03	1.20E+00	1 E-04

Total Lifetime Weighted Risk for Vinyl chloride [A] Exposures=	**1 E-02**
Total Lifetime Weighted Risk for Trichloroethene [B2] Exposures=	**1 E-03**
Total Lifetime Weighted Risk for 1,1-Dichloroethene [C] Exposures=	**2 E-03**
Additional exposure pathways Exposure to sediments=	2 E-08
Inhalation exposure at streams=	8 E-10
Inhalation exposure at seeps & springs=	2 E-09

[ ] = carcinogenic classification of the compound

EXAMPLE:

Adult, groundwater, dermal contact (bathing)

Lifetime-weighted carcinogenic risk = CDI*CPF * factor

where factor = 58 years/68 years for adults

factor = 6 years/68 years for children ages 6-12

factor = 4 years/68 years for children ages 2-6

for TCE: lifetime-weighted risk = 0.0000218*.011*(58/68)

or 0.0000002

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The carcinogenic risk from actual exposure to VOCs in the streams and springs is presented in Table 6-4. The calculated risk for children ages 6-12 from 1) dermal contact with these waters is 4×10^{-10} 2) inhalation of VOCs in the surface water is 2×10^{-8} and 3) dermal contact with stream sediments is 2×10^{-8}. All of these risks are at least an order of magnitude below the U.S. EPA's recommended range of 1×10^{-4} to 1×10^{-7} at CERCLA sites.

6.5 Calculation of Aquatic Life Criteria

The comparison of aquatic life criteria with the actual concentrations in the stream water and stream sediments is the final step in the surface water assessment. Fresh water aquatic life standards were readily available for several of the compounds detected at the Kimberton Site. However, for a majority of the compounds, no fresh water acute or chronic aquatic life standards were available. It was therefore necessary to develop these criteria using a variety of available information, including saltwater aquatic life criteria, LC_{50} (lethal concentration with 50% kill) values, and the aquatic life criteria for similar compounds.

The development of aquatic life criteria for the specific compounds is outlined below, and the results of this development are presented on Table 6-5.

The acute values obtained from Verschueren (1983) were the lowest LC_{50} values referenced in that book. Where only one LC_{50} value was reported, an LC_{50} value was estimated by division by 50 (i.e., safety factor for limited data base). At this site, the safety factor of 50 was not used based on sufficient data.

a. Fresh water chronic criteria for toluene do not exist. An estimated chronic standard is derived based on an acute to chronic ratio of 1.3 obtained from the marine acute (6.3) to chronic (5.0) criteria ratio (U.S. EPA, 1986d) and a safety factor of 10. Thus, the fresh water chronic criteria for toluene is:

$$\frac{17.5 \text{ (acute criteria)}}{[1.3 \text{ (marine acute/chronic ratio)} \times 10]} = 1.35 \text{ mg/L}$$

b. Values for chlorinated benzenes as a class were calculated (U.S. EPA, 1986d).

c. A fresh water chronic criteria for fluoranthene does not exist. This value is derived based on a marine acute (40) to chronic (16) ratio of 2.5 (U.S. EPA, 1986d) and a safety factor of 10. Therefore, the fresh water chronic criteria for fluoranthene is:

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$$\frac{4.0 \text{ (acute criteria)}}{[2.5 \text{ (marine acute/chronic ratio) } \times 10]} = 0.16 \text{ mg/L}$$

d. The only available water quality standard for polyaromatic hydrocarbons (PAHs) is the marine acute criteria (LOEL or lowest observed effect level) = 0.3 mg/L. This value is not compound-specific, but is based on polyaromatic compounds as a class. The respective values for the remaining PAHs used the values calculated for fluoranthene.

e. Based on the chronic to acute ratio of 0.16/4.0 for fluoranthene.

A comparison of the actual concentrations of compounds detected in the streams with the aquatic life criteria is presented in Table 6-6. The comparison of concentrations of compounds detected in stream sediments with calculated sediment criteria was presented in the RI report (Section 7.5). In summary, compounds detected in surface water and stream sediment samples do not exceed ambient water quality criteria either calculated or U.S. EPA values.

6.6 Risk Perspective

The hydrogeology of the Kimberton area is typical of the Chester County region as a whole. Water levels fluctuate in response to seasonal precipitation and evapotranspirational trends. The water table closely mimics topography with the dominant recharge areas lying in the higher elevations and discharge zones noted through local springs and streams at low elevations. Ground water gradient and flow within the site area are directionally controlled by elevational changes in pressure head. Under natural and current pumping conditions, the direction of ground water flow is oriented toward the northeast, north and northwest toward the local discharge zones.

No additional lifetime risk is expected to result because of the previously installed carbon treatment systems. Actual surface water exposure does not result in any additional lifetime risk.

An additional hypothetical lifetime risk from use of untreated ground water containing trichloroethene, 1,1-dichloroethene, and vinyl chloride is calculated to be 1×10^{-3} [B2], 2×10^{-3} [C], and 1×10^{-2} [A], respectively, for affected residential areas to the north, northeast, and northwest of the site. Vinyl chloride concentrations are localized in the north-central portion of the site. It is important to note that U.S. EPA's methodology for calculating cancer risk is based upon a set of conservative assumptions and does not provide an accurate estimate of risk,

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but rather a probability that the risk will not exceed the derived estimate. The uncertainty inherent in EPA's methodology is described in Section 2.

The lifetime risk of cancer from all causes is 0.20 to 0.25. That is, approximately 20 to 25 percent of all people develop cancer in their lifetimes. The estimated additional lifetime risk of cancer from consuming untreated ground water (in the hypothetical scenario) containing vinyl chloride, 1,1-dichloroethene and TCE is 1×10^{-2}. This means for every 100 people living near the site, an additional 1 cancer is expected to develop in a lifetime period (70 years). This estimate is based upon the lifetime-weighted average for the three age groups evaluated in the hypothetical scenario that the existing carbon treatment systems were not in place and operational that an alternate water source is not available.

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- **Hypothetical**

  - Noncarcinogenic hazard indices from trans-1,2-DCE exposure in untreated ground water exceed one,

  - Carcinogenic risks from trichloroethene, 1,1-dichloroethene, and vinyl chloride exposure in untreated ground water are 1×10^{-3} [B2], 2×10^{-3} [C], and 1×10^{-2} [A], respectively which are 1 to 2 orders of magnitude above the U.S. EPA's recommended guidelines of 1×10^{-4} to 1×10^{-7} for CERCLA sites, and

  - Applicable or relevant and appropriate requirements for untreated ground water use are exceeded.

- There are no special habitats or species at the site and no indication of stressed vegetation at ground water discharge points. The wetlands appear to be healthy and functional and are not impacted by compounds detected at the site.

- Comparison of aquatic life criteria with the actual concentrations in the stream and stream sediments shows that the aquatic life criteria are not exceeded.

It should be noted that the carcinogenic risk at the site was estimated based on people utilizing ground water for drinking and bathing purposes. This exposure scenario does not currently exist in that the residents within the affected area are supplied with carbon treatment systems.

The hypothetical exposure scenario and subsequent risk calculations were addressed only to determine the degree of risk posed by chemical compounds in the ground water such that various remedial alternatives could be ranked. <u>Thus, the calculated carcinogenic and noncarcinogenic risk posed by compounds in the ground water to the residential area does not exist at this time.</u>

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ATTACHMENT 2

FINAL REVISIONS TO FEASIBILITY STUDY REPORT

1. Replace Title Page with the attached Title Page (Revised).
2. Replace Figures 1-3, 1-4, and 1-6 with the attached Figures 1-3, 1-4, and 1-6 (Revised).
3. Replace Table 1-10 with the attached Table 1-10 (Revised).
4. Replace Page 2-4 with the attached Page 2-4 (Revised).
5. Replace Figures 2-2, 2-3, and 2-4 with the attached Figures 2-2, 2-3, and 2-4 (Revised).
6. Replace Table 4-1 with the attached Table 4-1 (Revised).
7. Replace Page 5-2 with the attached Pages 5-2 and 5-2A (Revised).

FEASIBILITY STUDY REPORT
KIMBERTON, PENNSYLVANIA
NPL SITE

10 March 1989
Revised 15 May 1989

Prepared By:

Environmental Resources Management, Inc.
855 Springdale Drive
Exton, Pennsylvania 19341

File No.: 272-15-06

AR302280

Figure 1-3
GAC System Locations
Monsey/CIBA-GEIGY
Kimberton, Pennsylvania

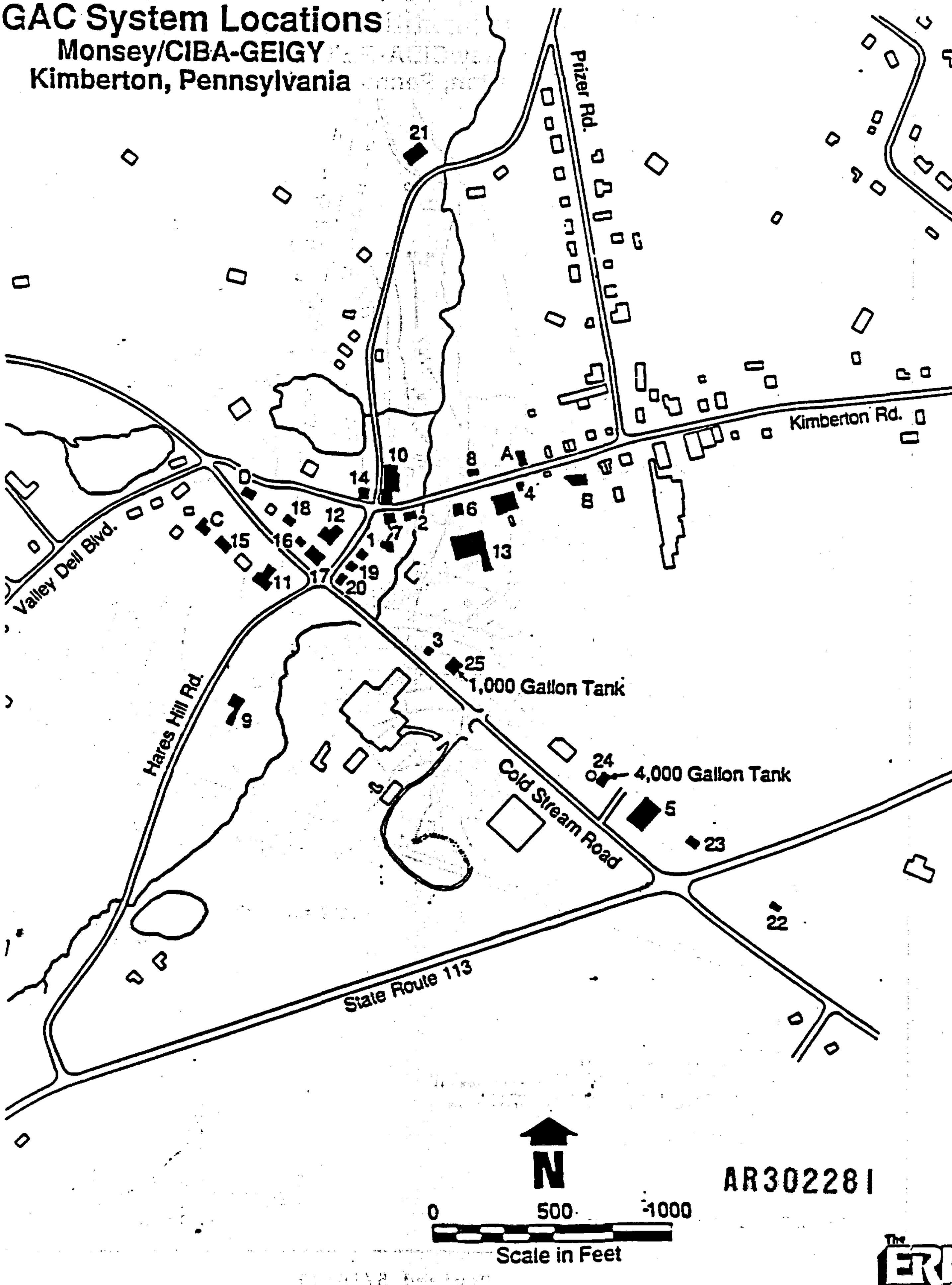

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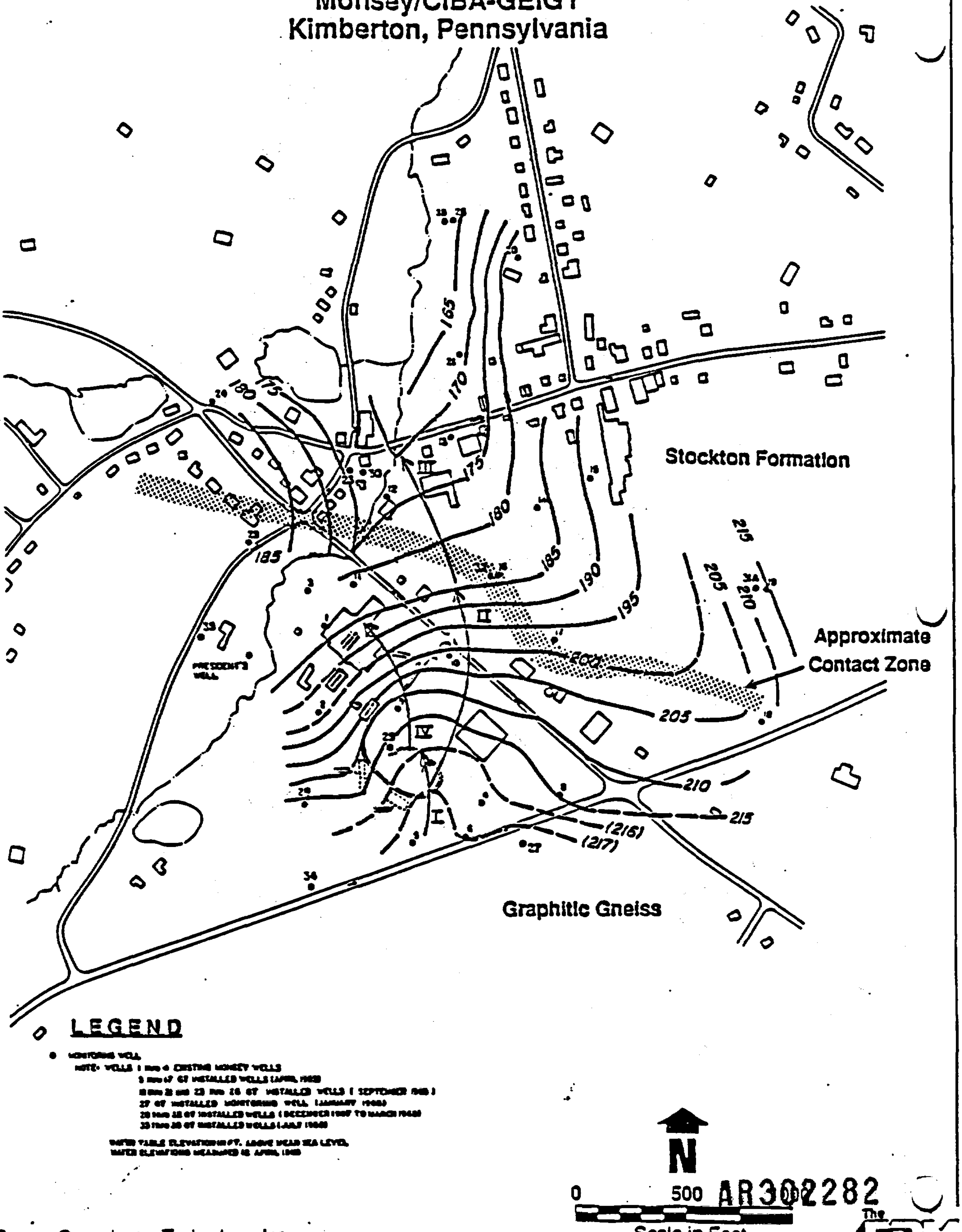
Figure 1-4
Flow Lines Used in Interstitial Velocity Calculations
Monsey/CIBA-GEIGY
Kimberton, Pennsylvania



Source: Groundwater Technology, Inc.

AR302282

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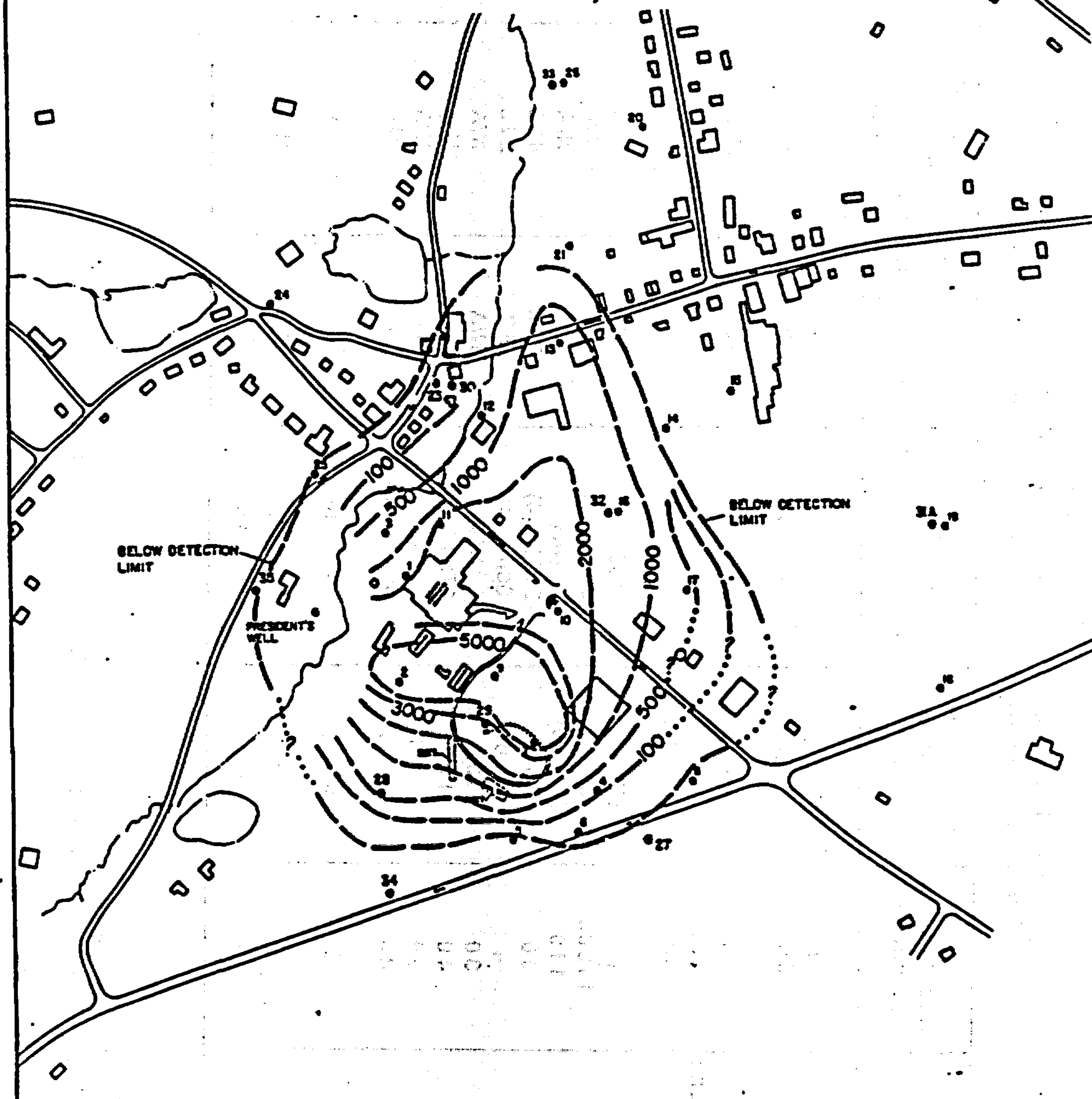
Figure 1-6
Total Volatile Concentrations (ppb)
June 1986 & March, June, August 1988
Monsey/CIBA-GEIGY
Kimberton, Pa.



LEGEND

N

0 500 1000
Scale in Feet

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Source: Groundwater Technology, Inc.

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TABLE 1-10

Relevant and Appropriate Requirements for Ground Water

(all concentrations are in µg/L, unless otherwise specified)

Compound	Ground Water Concentration Maximum	Acceptable Drinking Water Level	US EPA Health Advisory (long-term adult)	Acceptable Intake Chronic (1) (µg/kg/day)	Acceptable Intake Subchronic (1) (µg/kg/day)
Vinyl Chloride	690	2 (a)	46 (3)	NA	NA
1,1-Dichloroethene	50	7 (a)	7 (4)	9	N/A
1,1-Dichloroethane	60	4,200-42,000*	N/A	120	1200
trans,1,2-Dichloroethene	7600	100	70 (4)	10 (5)	270 (5)
1,1,1-Trichloroethane	150	200 (a)	200 (4)	540	N/A
1,3-Dichloropropene	11	87 (6)	100 (3)	N/A	N/A
Trichloroethene	11000	5 (a)	250 (3)	NA	NA
Acrolein	110	540 (6)	N/A	N/A	N/A
Toluene	30	2000	2420 (4)	300	430
Chlorobenzene	4	100	300 (4)	27	270
Chloroethane	30	N/A	N/A	N/A	N/A
Methylene Chloride	40	1750	1750 (3)	60	N/A
Chloroform	60	100 (a)	N/A	10	N/A
1,2-Dichloroethane	20	5 (a)	2,600 (3)	NA	NA
Carbon Tetrachloride	8	5 (a)	250 (3)	NA	NA
1,2-Dichloropropane	8	5	0.56 (2)	N/A	N/A
Tetrachloroethene	10	0.7**	10 (4)	NA	NA

(a) - US EPA MCL (final)
NA - Not applicable
N/A - Insufficient data to develop criteria
*Based on Acceptable Intake Chronic and/or Acceptable Intake Subchronic x 70 kg x 1(2 L)
**Health Advisory
(1) Acceptable Daily Intake US EPA 1986
(2) Health Advisory - reference concentration for potential carcinogens based on 10E-06 cancer risk, US EPA 1986
(3) US EPA Health Advisory for long-term exposures 70 kg adult
(4) US EPA Health Advisory for lifetime exposure for 70 kg adult (update on PHRED 5/8/89)
(5) Calculated from Health Advisory
(6) US EPA Ambient Water Quality Criteria - adjusted for drinking water only (10E-06 cancer risk)

2.3 Determination of Contaminated Media Quantities

2.3.1 Ground Water

The areal extent of ground water contamination at the Kimberton Site has been determined from monitoring well data. The isoconcentration contours of volatile contaminants are shown on Figure 1-6. The relationship between areas within the ground water isoconcentration contours and contaminants present in the aquifer is shown in Table 2-2.

2.3.2 Surface Water

The mass flow rates of VOCs currently entering the surface water by springs and seeps are:

A-10:	343 pounds/yr,
A-12:	13 pounds/yr,
A-14:	<1 pounds/yr,
A-15:	0 pounds/yr, and
C- 3:	13 pounds/yr.

The locations of these springs and seeps are shown in Figure 1-7. Because Spring A-10 is the primary source of VOCs to surface water, remediation of surface water will specifically involve mitigation of contamination from Spring A-10. The flow in Spring A-10 was measured in April 1988 to be 49 gpm. Therefore, this quantity of water will be considered for continuous collection and treatment.

2.4 Identification of Potential Remedial Technology Types and Processes

Technology types and associated processes that are potentially appropriate for the Kimberton Site have been identified as shown in Table 2-3. Each of these technologies will be described and screened according to the following criteria:

- Effectiveness: Each remedial technology must be evaluated according to its effectiveness in protecting human health and the environment. Treatment technologies are evaluated on their effectiveness in removing site-specific constituents from the contaminated media.

- Ability to Meet Remedial Objectives: Remedial technologies will be evaluated based upon their ability to reduce the concentrations and mass of VOCs in the aquifer and/or their ability to mitigate the extent of VOCs entering the surface water.

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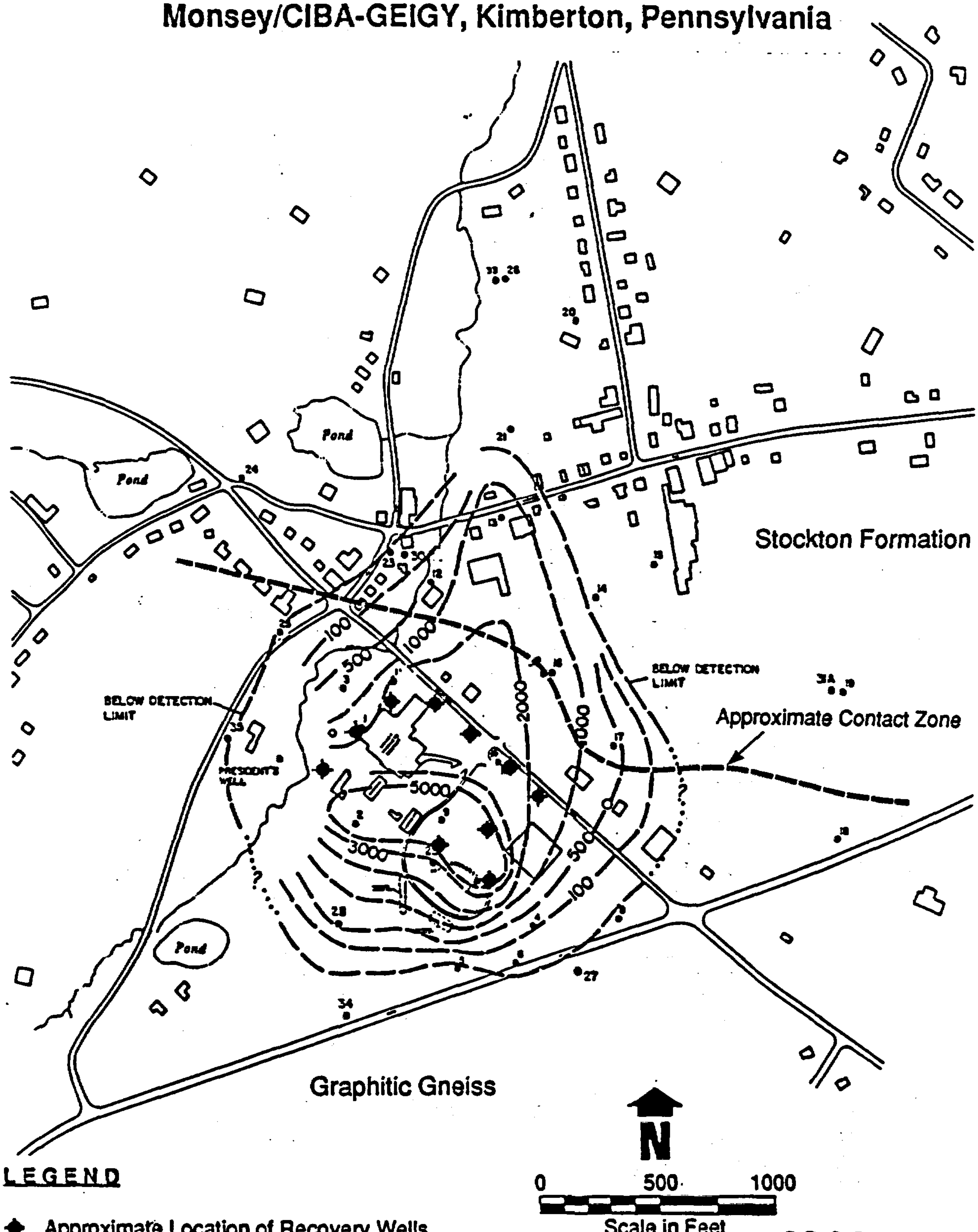
Figure 4-2
Alternative 4 - On-Site Source Control and Ground Water Remediation
Monsey/CIBA-GEIGY, Kimberton, Pennsylvania



LEGEND

◆ Approximate Location of Recovery Wells

3000 Approximate Total VOC Concentration

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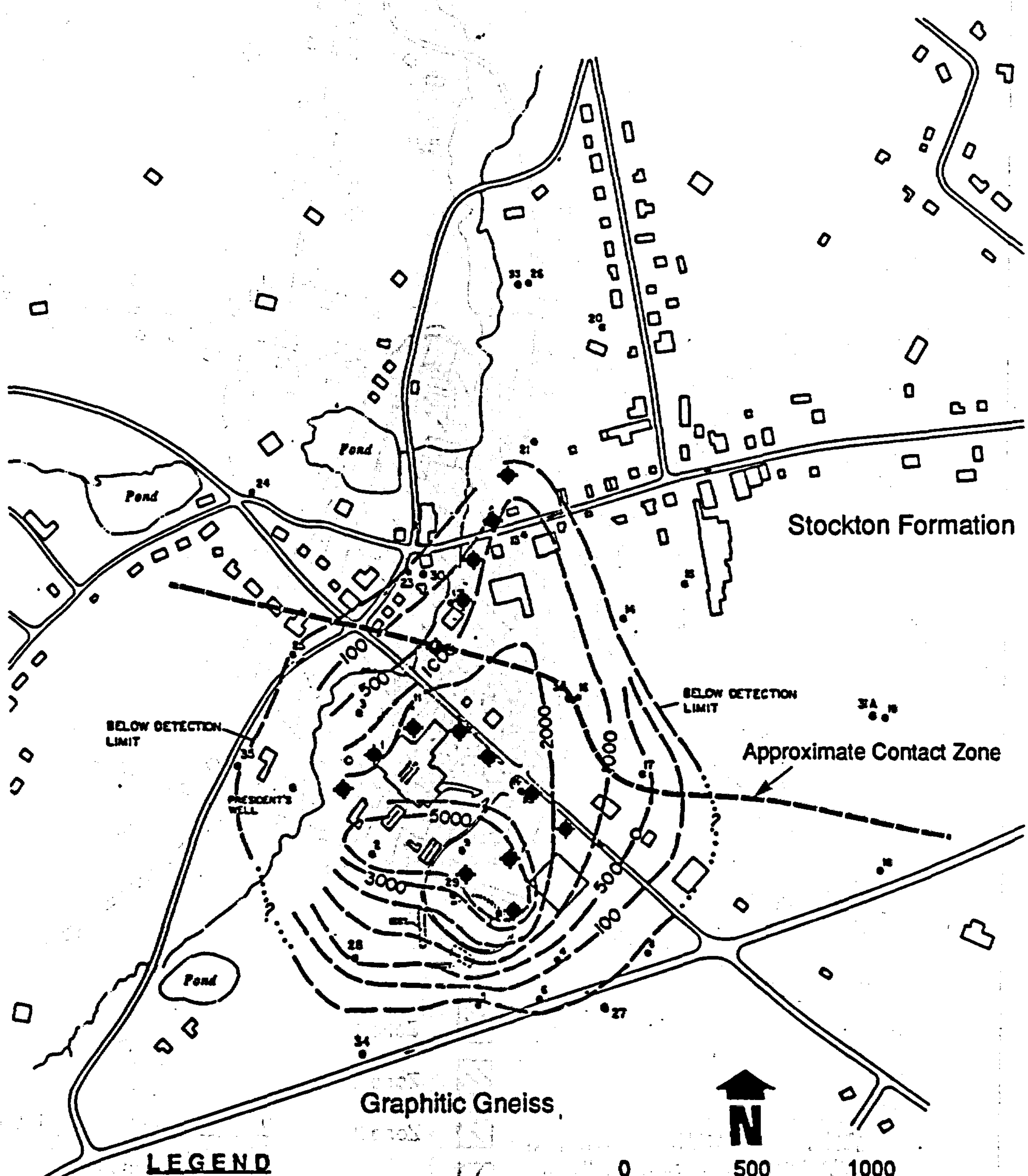
27215 06 01	Revised by / Date:	Checked by / Date:	

Revised 5/10/89

Figure 4-3
Alternative 5 - On-Site Source Control and Ground Water Remediation and Off-Site Ground Water Remediation
Monsey/CIBA-GEIGY, Kimberton, Pennsylvania



LEGEND

◆ Approximate Location of Recovery Wells

—5000— Approximate Total VOC Concentration

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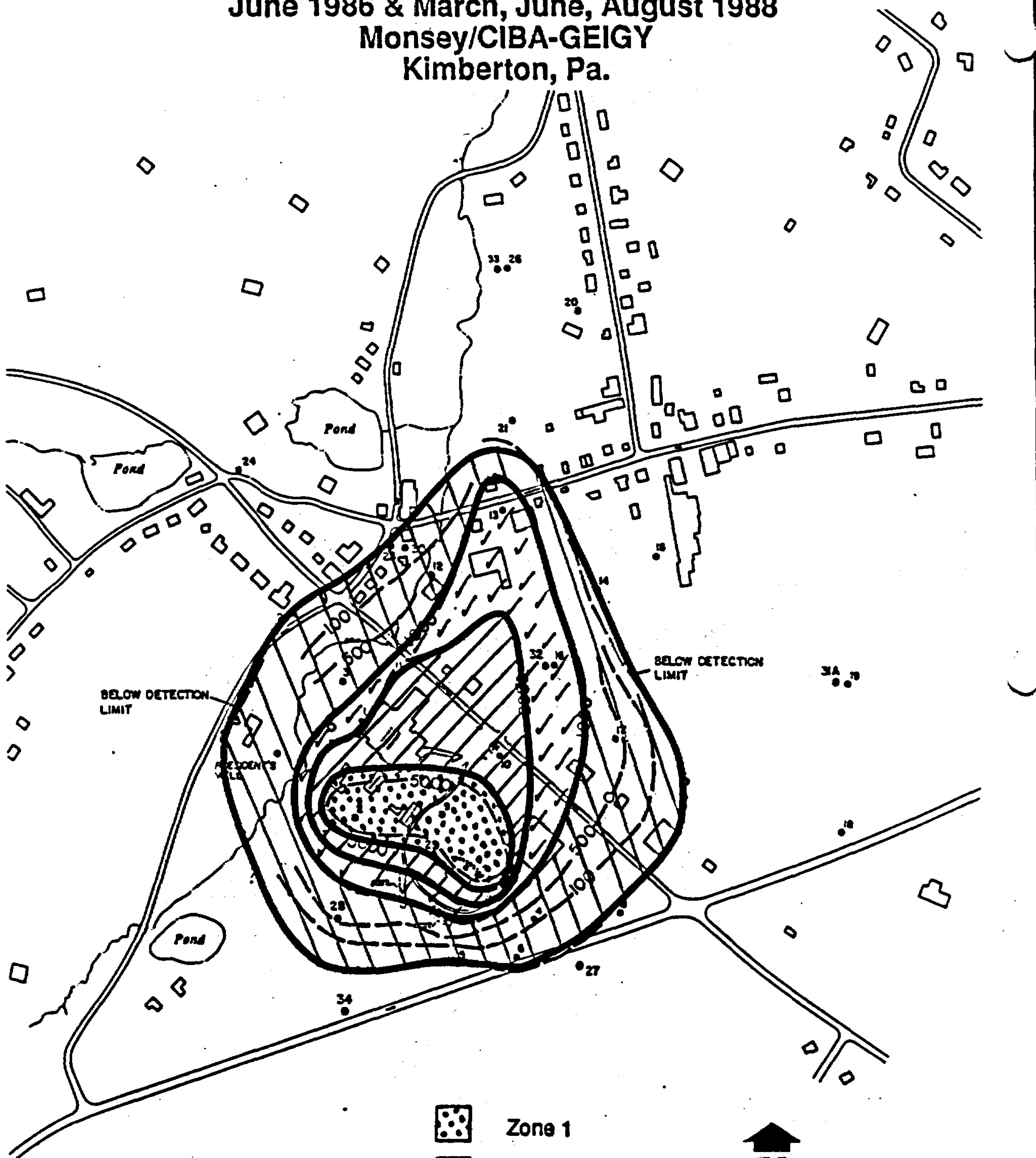
27215 06 01	Revised by / Date:	Checked by / Date:	

Revised 5/10/89

Figure 4-4
Total Volatile Concentrations (ppb)
June 1986 & March, June, August 1988
Monsey/CIBA-GEIGY
Kimberton, Pa.



Zone 1

Zone 2

Zone 3

Zone 4

N

0 500 1000
Scale in Feet

LEGEND

● MONITORING WELL

NOTE: WELLS 1 thru 4 EXISTING MONSEY WELLS
5 thru 17 GT INSTALLED WELLS (APRIL 1986)
18 thru 21 and 23 thru 26 GT INSTALLED WELLS (SEPTEMBER 1986)
27 GT INSTALLED MONITORING WELL (JANUARY 1986)
28 thru 32 GT INSTALLED WELLS (DECEMBER 1987 TO MARCH 1988)
33 thru 36 GT INSTALLED WELLS (JULY 1988)

* WELL 16 DATA OMITTED FROM ANALYSIS DUE INCONSISTENCY WITH HISTORICAL DATA

Source: Groundwater Technology, Inc.

(See Table 4-1 for explanation of zones)

AR302288

WO# 27215 06 01	Drawn by / Date: EJK 1/89	Checked by / Date: D. Watkins 1/89	The ERM Group
	Revised by / Date:	Checked by / Date:	

Revised 5/10/89

TABLE 4-1
DETERMINATION OF VOC CONCENTRATIONS
WITHIN VARIOUS AQUIFER ZONES AND IN SPRING A-10

Zone**	Well	Average Concentration (ppb)*				Total VOCs (ppb)
		Trichloroethene	t-1,2-Dichloroethene	Vinyl Chloride	1,1-Dichloroethene	
1	2	254	6,117	183	5	
> 3,000 ppb VOCs	7	6,300	4,215	278	39	
	9	6,313	1,050	–	–	
	Maximum	6,313	6,117	278	39	12,747
2	10	1,232	1,102	–	–	
2,000 - 3,000 ppb VOCs	29	2,100	700	–	–	
	Maximum	2,100	1,102	–	–	3,202
3	1	250	540	690	–	
1,000 - 2,000 ppb VOCs	11	747	937	164	25	
	13	594	637	–	10	
	16	1,045	964	315	21	
	32	433	530	–	7	
	Maximum	1,045	964	690	25	2,724
4	President's	48	1,053	–	–	
Trace - 1,000 ppb VOCs	3	197	603	–	–	
	4	96	62	49	–	
	5	–	–	–	–	
	6	13	–	–	–	
	8	27	6	–	–	
	12	563	1,050	–	7	
	17	608	323	–	13	
	23	16	21	–	–	
	25	–	3	–	–	
	28	397	147	–	–	
	30	4	4	–	–	
	Maximum	608	1,053	49	13	1,723
Spring A-10	–	800	790	–	9	
	Maximum	800	790	0	9	1,599

*Based on all samples analyzed from 5/85 henceforth.
**Zones were established based upon the approximate total VOC isoconcentration contours developed from the most recent monitoring well data (June 1986 & March, June, August 1988).

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5.2 Detailed Evaluation of Alternatives

5.2.1 Short-Term Effectiveness

The evaluation of the short-term effectiveness of each remedial action includes consideration of 1) the protection of the community during the remedial action(s), 2) the protection of the workers during the construction phase of the remedial action(s), 3) the environmental impacts of the remedial action(s), and 4) the length of time required to achieve the remedial response objectives.

5.2.1.1 Protection of the Community

None of the alternatives would generate short-term risk to public health. Alternatives 3 and 4 involve treating ground and/or surface water by air stripping; however, the emissions generated have been determined to be within safe limits.

5.2.1.2 Protection of the Workers

Alternatives 3 and 4 require construction of a surface water collection system and/or a ground water extraction system. Workers constructing the surface water collection system (Alternatives 3 and 4) would require protection against dermal contact with surface water (i.e., tyvek coveralls and gloves). Workers drilling the extraction wells (Alternative 4) would not only require protection against dermal contact, but could potentially require respiratory protection. This determination would be made in the field based upon air monitoring measurements.

5.2.1.3 Environmental Impacts

Construction activities for implementation of Alternatives 2 and 3 are absent or minimal, and thus would not generate adverse environmental impacts. Implementation of Alternative 4 would include ground water extraction, which could adversely affect the ground water supply available to residents in the area. However, because a public water system shall be installed, there is expected to be no continued extraction of ground water from nearby domestic wells.

5.2.1.4 Time Until Response Objectives are Achieved

Alternatives 3 and 4 would require the collection and treatment of Spring A-10. This would provide an immediate improvement in water quality in Stream A. Alternative 2, however, would not provide any improvement in water quality in Stream A.

Alternative 4 is the only alternative that would provide ground water remediation. Ground water would be extracted and treated thereby containing VOCs from migrating off site. It is presently anticipated that ground water extraction and treatment could be